Enhancing Safety Culture at NASA
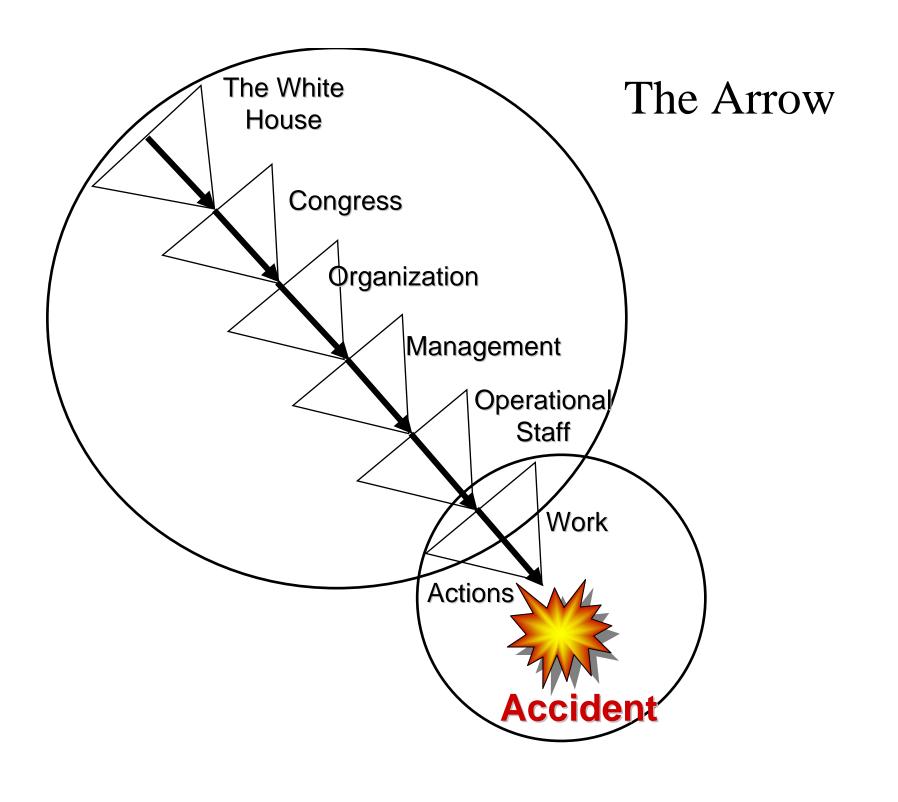
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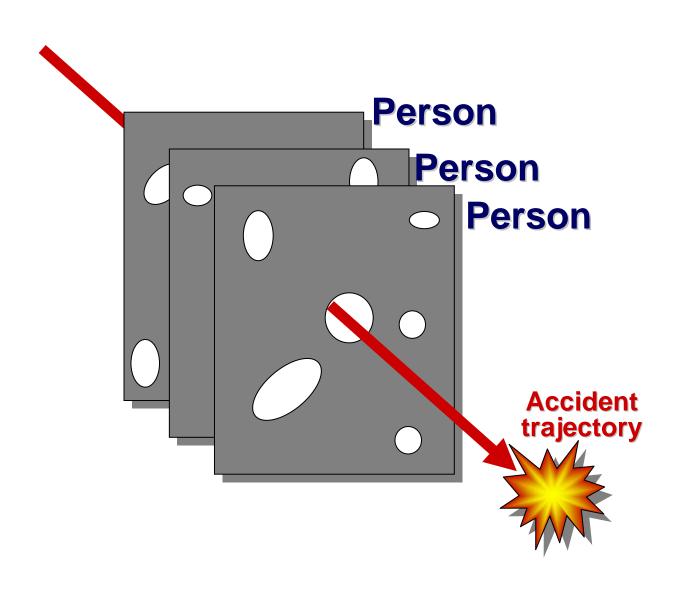karlene@haas.berkeley.edu

Research Supported by USRA

- Tailor made safety culture-climate survey to meet NASA's needs
- Survey originally normed on over 100,000 respondents
- Based on over twenty years of research on high reliability organizations
- Includes 47 (Likert scale) items

Today's Presentation

- Describe how catastrophes happen
- Reminder of CAIB's prescription
- Describe high reliability organizations
- Discuss the theory behind the instrument
- Identify organizations that have tried to become highly reliable
- Describe the web based instrument
- Describe one implementation at NASA

The Arrow

The White House

Congress

Organization

Management

Operational Staff

Work

Actions

Accident

Swiss Cheese Model

Person

Person

Person

Accident trajectory

Columbia Accident Investigation: Excerpts from CAIB Report

- *In the boards view, NASA's organizational culture and structure had as much to do with the accident as the External Tank Foam (CAIB, p. 177).*

- *The board determined that high-reliability theory is extremely useful in describing the culture that should exist in the human space flight organization (CAIB, p. 181).*

- *CAIB discusses differences between the US Navy and NASA in terms of safety culture and operation as an HRO. And CAIB concludes that NASA could substantially benefit by following the Navy's example and best practices (New York Times, July 21, 2003).*

What is an HRO ?

- An organization
  - conducting relatively error free operations

  - over a long period of time

  - and making consistently good decisions resulting in

  - high quality and reliability operations

Characteristics of a HRO

- A culture of trust, shared values, and risk mitigating communication processes.

- Communication that provides opportunities for open discussion and improvement.

- Distributed decision-making, "where the buck stops everywhere."

(Roberts, 1997)

Five Element HRO Model

- <u>Process auditing</u> - a system of on-going checks to monitor hazardous conditions

- <u>Reward system</u> – expected social compensation or disciplinary action to reinforce or correct behavior

- <u>Quality assurance</u> – policies and procedures that promote high quality performance

- <u>Risk management</u> – how the organization perceives risk and takes corrective action

- <u>Leadership and Supervision</u> – policies, procedures, and communication processes used to mitigate risk

High Reliability Organizations

Reward & Recognition

-Drive the correct behaviors
-Value contribution of the line

Process auditing

- spot the expected and unexpected

Migrate decision making to the appropriate person

Senior managers who see the big picture

Quality Systems

Formal rules and procedures

Depth/Org. Capacity

Training

- High technical competence

Risk Perception

– Knowledge that risks exist?

-Extent to which risk is acknowledged and mitigated

Organizations Targeting High Reliability Operations

- U.S. Navy and Marine Corps

- U.S. Coast Guard

- U.S. Department of Energy (National Laboratories)

- Commercial Banking (e.q. S.W.I.F.T., RMA)

- Commercial Airlines (United, Alaska)

- Insurance (e.g. Swiss Reinsurance)

- Healthcare (e.g. Loma Linda Hospital Pediatric Intensive Care Unit, Kaiser Permanente Peri Natal Units and Information Technology etc.)

- Commercial Nuclear Power (e.g. Diablo Canyon Power Plant)

- Commercial Maritime Industry (e.g. Chevron, Arco, BP)

- Community Emergency Services (e.g. Orange and San Bernardino Counties, CA Fire Authorities)

- Dutch National Railroad

- Petroleum Helicopters Inc

- Embry Riddle Aeronautical University

- The Italian Air force

- U.S. Fish and Wildlife Service

Proof of Concept Process

- Top managers met with researchers to discuss the metric and its potential uses
- Researcher(s) spent two to three days interviewing a strata of management and operational personnel
- Together researchers and unit personnel tailor made metric items to fit the local situation
- Test metric on a small sample
- Decide on large scale data collection process and feedback strategy
- Implement survey
- Provide feedback
- NASA decides on its own change/implementation strategies with help of researchers

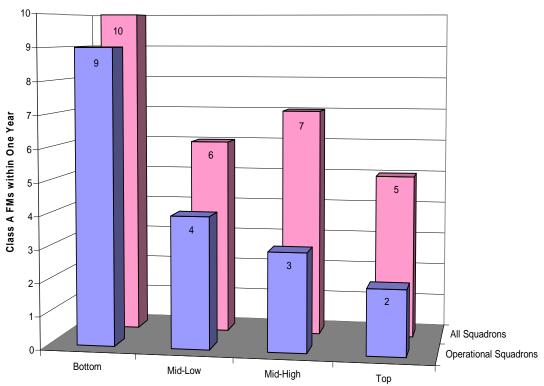# Characteristics of the Safety Assessment Survey (both military and commercial)

- Proof of concept for the particular industry
- Anonymity for participants and confidentially for unit managers
- **Online survey administration**
- Immediate diagnostic results feedback
- Benchmark comparisons within and across industries
- Trend analysis and intervention strategies

The Link Between Safety Culture and Performance in the Navy

- Lower and higher level personnel in both organizations perceive differences in attention to safety
- The Navy is now able to link OSES results to performance
- Other data show similarities for civilian hospitals OSES data to similar data collected in hospitals
- The Navy data base can be used in comparison with similar data from any other kind of unit (e.g. NASA unit)
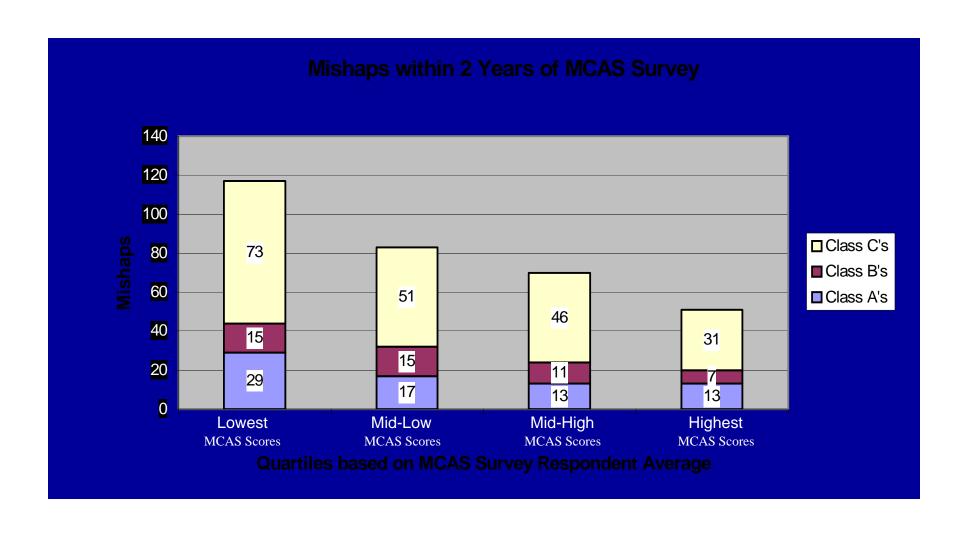- Comparison data are also available from the aerospace industry

Mishaps within One Year after Taking CSA (Class A: Major Accidents)

(Surveys conducted from 01JUN04-31MAY05)

(Schimpf and Figlock, 2006)

MCAS Respondent Average
-vs-
Mishap Frequency

Passcode   enter NASA

Anonymity   About   Sample   Contact
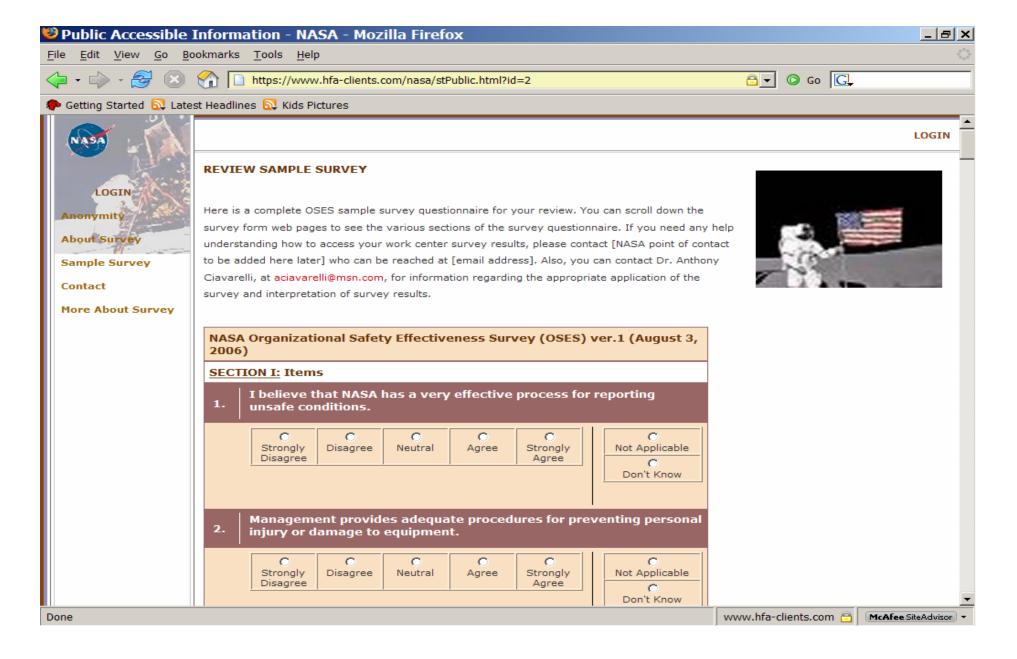   Survey   Survey

WELCOME

WELCOME to the Organizational Safety Effectiveness Survey (OSES) for the
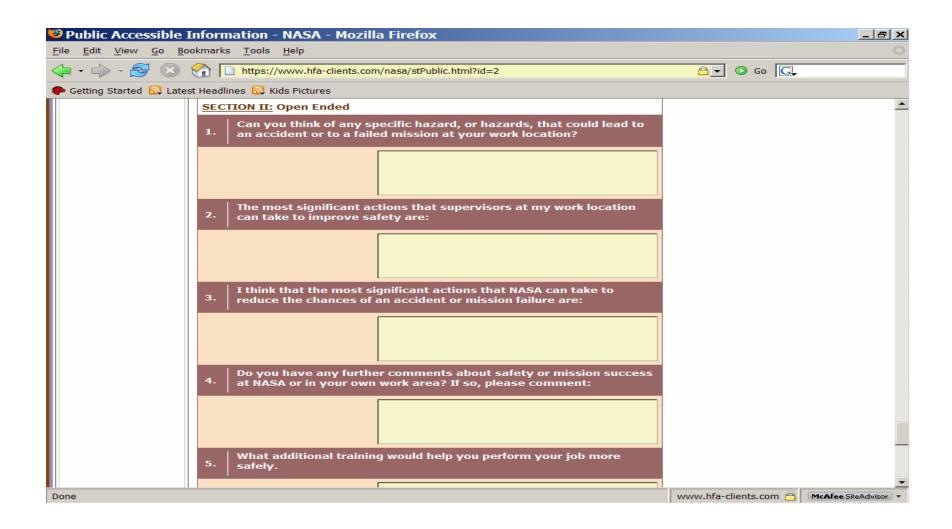National Aeronautics and Space Administration (NASA).

This safety climate survey was developed specifically for NASA to provide us with
a means to monitor and to continuously improve our safety performance and
mission success. Use of this survey, along with other ongoing safety initiatives,
puts NASA in the forefront of advances in safety program management and
mission assurance. The survey is based on 10 years of research by US Navy
safety specialists and organizational scientists working at several top-rated
American universities. Additional background information regarding the
development of the OSES can be found by clicking on **About Survey.**

In order to take the safety climate survey and submit your responses, however,
you will need a password, which will be provided to you by your immediate
supervisor. You can view the entire survey by clicking **Sample Survey**, without
the need for a password.

NASA OSES Web Site: Survey Items

NASA OSES Web Site: Verbal Items

SECTION II: Open Ended

1. Can you think of any specific hazard, or hazards, that could lead to an accident or to a failed mission at your work location?

2. The most significant actions that supervisors at my work location can take to improve safety are:

3. I think that the most significant actions that NASA can take to reduce the chances of an accident or mission failure are:

4. Do you have any further comments about safety or mission success at NASA or in your own work area? If so, please comment:

5. What additional training would help you perform your job more safely.

Sample Items from NASA Version of Organizational Safety Effectiveness Survey
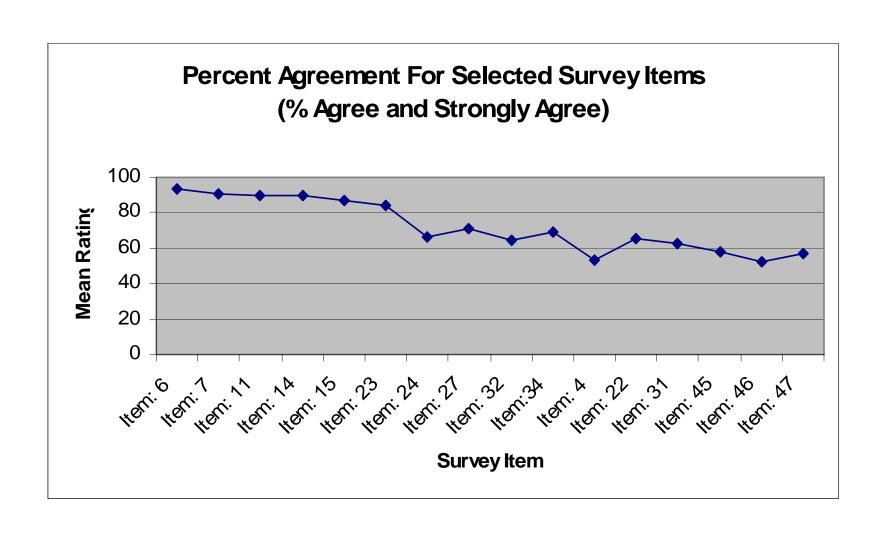
Answered on a 1-5 scale

- Our process of accident and incident investigation is effective at identifying root causes (process auditing)
- I am comfortable reporting safety concerns without fear of management reprisal (safety culture and reward)
- My work group closely monitors work quality and corrects any deviations from established quality standards (quality assurance)
- Production pressures often force us to cut corners to accomplish our work (risk management)
- My supervisor can be relied on to keep his/her word (command and control)

NASA Initial Survey Tryout

- 21 organizations
- 236 surveys completed
- Return rate: 236/590 = 27%
  - Range from less than 1% to 100%

Averages for Selected Survey Items

Percent Agreement For Selected Survey Items
(% Agree and Strongly Agree)

Verbal Survey Items: Questions

1.   The top three hazards that could lead to an accident or to a failed mission at my work area are:

2.   I think that the most significant actions that we can take to reduce the chances of an accident or mission failure are:

3.   Do you have any further comments about safety or mission success at NASA-Goddard or in your own work area?

4.   Can you think of any way that we can improve the process of this survey, or do you have comments regarding this survey?

Top Hazards: Sample Comments

- **Excessive work hours needed to maintain critical launch schedules.**

- Almost unlimited access of visitors, including small children, to facilities; especially during operations.

- We have facilities and grounds issues that need to be addressed. Specifically, broken sidewalks present tripping hazards. Broken doors could prevent emergency exit. Leaking roofs could lead to electrical fires if electrical boxes get wet, as well as present slipping hazards from wet floors.

Top Hazards: Sample Comments

- **Yes, uncontrolled laser beam**
- **Slipping and falling**
- Children being allowed to be in work areas
- Our Risk management procedure contains bad mathematics
- **Office environment -- trips and falls on wet floors may be the most common accident**
- Improper use of chemical PPE could lead to injury. Also improper clean up of a chemical spill could lead to injury to people or hardware.

Improvements to Safety and Mission Success: Sample Comments

- Keep safety as a number one priority
- Closely monitor and rate contractor performance.
- Safety reminders such as signs & bulletin postings and use of email
- Continue to broadcast the importance of safety emphasizing that "good" can be "better".
- **Put safety ahead of schedule requirements.**
- Provide training and post reminders

Improvements to Safety and Mission Success:
Sample Comments

- **Communicate to the employees at the working level** that there are certain things that they do that are hazardous and they need to take safety seriously. Many employees have been working in a lab since college and think there is nothing unsafe happening in these labs and think safety doesn't apply to them. This could lead to injury or other exposure to hazard that could lead to long term consequences.

Improvements to Safety and Mission Success: Sample Comments

- Continually promote hazard awareness
- Put teeth into existing programs. Be conscientious in conducting quarterly safety inspections.
- **Follow up on discrepancies** - don't just leave it to the FOM or Deputy PM4.n/a5.
- Actually observe what goes on around
- **Listen to employees suggestions**

Summary of OSES Findings: Highlights

- Work-schedule pressures and possible fatigue
- Cutting Corners to finish work on time
- Direct Supervisory Involvement in safety
- Employee empowerment and reward
- Training needed in some high risk areas
- Risk Analysis and Decisions (method and responsibilities)
- General morale and worker-supervisor communications
- Differences across departments in safety climate ratings

Suggested Change Implementations

- Focus groups to deal with schedule pressures and fatigue
- Workshop practicums for improving supervisory involvement in safety
- Training for some high risk jobs
- Workshops addressing decision making strategies
- Workshop/exercises to improve communications
- Develop or adapt a program manager Leadership Fieldbook
- Find examples of workable activities from other organizations

From HRO   to LRO

Which are we?
Weick, Sutcliffe, Obstfeld (1998)

- In LROs people:
  - Attend meetings and solve nothing
  - Catch airplanes and miss 'connections.'
  - Conduct briefings and persuade no one
  - Evaluate proposals and miss winners
  - Meet deadlines for projects on which the plug has been (or should be) pulled
  - Shuffle papers and lose a few

Which are we?

- In LROs people:
  - Have underdeveloped cognitive infrastructures
  - Focus on efficiency
  - Are inefficient learners (episodic)
  - Lack diversity (focus on conformity)
  - Filter information & communications
  - Reject early warning signs of quality degradations